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Luigi Rolando (1773–1831)

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Luigi Rolando was born on the 16th June 1773 in the Piedmontesan town of Torino. When his father died he was raised by an uncle, the priest Antonio Maffei. He studied medicine at his hometown university and took a particular interest in anatomy and zoology. The anatomist Giovanni Francesco Cigna (1734–1790), known for his research on magnetism and electricity in animals regarded him as his most promising disciple. In 1792 Rolando began practising medicine. In 1801/2 he presented a doctoral thesis on comparative anatomy about the structure and function of the lungs [1]. In 1799 the duke of Savoy, Piedmont and Aosta, Vittorio Emanuele I, was forced to emigrate to Sardinia in the wake of the revolutionary wars and in 1804 invited Rolando to come to Sardinia as professor of practical medicine at the University of Sassari. Because of an outbreak of yellow fever in Livorno he had to stop at Florence, where he stayed for three years. Here he got to know the anatomist Paolo Mascagni (1752–1815), then famous for his work on lymphatic vessels, and the physiologist Felice Fontana (1720–1805) who had been commissioned by the Grandduke Peter Leopold of Lorraine to establish the Imperial Royal Museum of Physics and Natural History ("La specola"), well-known for its collection of anatomical wax models. Here Rolando could improve his knowledge of anatomy and especially his proficiency in anatomical drawing – many of the illustrations in his publications originate from his own hand. From 1807 to 1814 Rolando lived in Sardinia and could return to Torino only after the Napoleonic wars. In his hometown he was appointed professor of anatomy, and functioned as physician to the royal family. He travelled to France and Great Britain, getting to know the most famous anatomists and physiologists of the time [2, 3]. From December 1829 he was also professor of anatomy at the *Accademia di Belle Arti* in Torino; soon afterwards he died, 20 April 1831, of cancer of the pylorus.

Rolando's achievements were not restricted to neuroanatomy. He contributed to zoology and entomology, for example in a monograph on the oleander hawkmoth, by discovering a new species of the echinoderms in the sea near Sardinia, and by describing the anatomy of "Bonellia viridis" which he named after the zoologist and collector Franco Andrea Bonelli (1784–1830) [1].

His contributions to neuroscience were praised as well as disparaged. Pierre Flourens (1794–1867), the distinguished French physiologist, judged Rolando's work to be without any impor-

tance and blamed him for having applied only crude anatomical methods [4], whereas Francois Magendie (1783–1855) thought him an "*auteur recommendable*" [5] and the medical historian Max Neuburger (1868–1955) saw Rolando as one of the most fascinating forerunners of Flourens [6].

To understand these different opinions it is necessary to understand that 17th and 18th century neurophysiology was interested in finding the 'seat of life', the nervous organ which, having been destroyed, was followed by immediate death. Thomas Willis (1621–1675) held the cerebellum responsible for involuntary movements essential to life (heartbeat, respiration). Though many scientists criticized this assumption, Rolando was the first to demonstrate that the cerebellum was not the 'seat of life'. In his publication of 1809 he maintained that the cerebellum was responsible for movements [7]. This work remained unknown for long because Rolando for almost a decade lived in scientific isolation on Sardinia. He had been prompted to experiment on the cerebellum of different animals by the remark of Vincenzo Malacarne (1744–1816) that there is a close relationship between the number of cerebellar lamellae and intelligence. Assuming that 'nervous fluid' and 'electrical fluid' were identical, Rolando reasoned that there must be an organ in animals which should secrete this fluid. By applying galvanic streams to the cerebellum he observed convulsions. After trephining the skull and removing nervous tissue he observed that animals "manifested clearest signs which indicate an absolute absence of locomotion." So he believed the cerebellum was an electromotor, similar to a voltaic pile. Here the nervous fluid originated and then was led "through the different nerves and brought to stimulate the muscles subservient to locomotion." His experimental method was too crude to investigate cerebellar function more precisely. Only later did Flourens arrive at defining the cerebellum as the organ of the coordination of movement.

One could mention other 'errors'. Rolando's embryological research convinced him that grey matter was by no means the matrix of nerve fibres [8]. He also thought that the crossing of fibres in the *decussatio pyramidum* was not a constant feature. Seen against the background of the state of experimental physiology and morphology of the central nervous system around 1800, Rolando was a brilliant and diligent observer. He was the first to describe the *substantia gelatinosa* (which today bears his name) in the posterior horn. And his experiments in decerebrated animals convinced him that the hemispheres are responsible for higher functions such as the will and judgement. To him the medulla oblongata was the long sought 'nodo della vita', the place where the most essential functions of life had their seat, because he observed that injuries to that structure immediately ended life [9]. Finally, Rolando was the first to detect consistency in the arrangement of the cortical gyri. Even up to the 1860s these seemed to many a mere chaos. To Rolando these convolutions could be "reduced to regular and specific shapes and positions" [8]. He found the central gyri to be constant features and described the *fissura centralis* [10], a structure that has become firmly linked with Rolando's name up to the present day.

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